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INTRODUCTORY LECTURE

TO A

COURSE OF CHEMISTRY:

READ AT THE

*LABORATORY IN OXFORD,*

ON FEBRUARY 7, 1797,

BY

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Mart. 2, 1797.

VICE-CAN. OXON.



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THE REVEREND THE VICE-CHANCELLOR,

THE HEADS OF HOUSES,

AND

THE MEMBERS

OF THE

UNIVERSITY OF OXFORD IN GENERAL,

THIS LECTURE

IS VERY RESPECTFULLY AND GRATEFULLY

INSCRIBED,

BY THEIR MOST OBEDIENT SERVANT,

ROBERT BOURNE.



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GENTLEMEN,

**B**EFORE I proceed to the scientific discussion of the subject of my Lectures, I think it right to employ one evening in offering some observations on the Utility of Chemistry, and in subjoining a few words on the object at which the Lectures will principally aim.

In speaking on the Utility of Chemistry, I shall not ~~make too free an use of~~ the licence, frequently assumed by public Readers, of delivering a panegyric on the art or science which they profess to teach, to the disparagement of other, equally, or perhaps more important branches of knowledge. But to assert the just claim of Chemistry to notice is commendable in any lover of the science; it is a duty which a person, situated as I am, owes to those who favour him with their attendance. Our earnestness in the pursuit of any study is, in general, proportionate to the plea-

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 sure or advantage which we expect to result from its cultivation. Where there is the prospect of recompence in one way or other, we can engage in literary or scientific labours with ardour; where there is no such prospect, the mind is seldom active in its exertions. A Lecturer, therefore, is ~~acting a proper part~~ towards his Hearers, when he states to them the fair pretensions that the art or science, which it is his province to explain, has to their regard; let him convince them that it is deserving of their attention, and then they will probably be attentive, unless he himself is deficient either in industry or capacity.

It was, on many accounts, unfortunate for Chemistry that its early cultivators, since the revival of Learning, directed the knowledge, which they had of its principles, to the solution of one or both of the following problems, *viz.* the transmutation of the baser metals into Gold, and the discovery of a medicine which should prevent or remedy all the disorders of the human frame. A few centuries ago, almost every Chemist was an Alchemist.



chemist. Experience shewed that, notwithstanding the boasts of Alchemy, each of the above problems remained unsolved : with regard to the former, it was observed, that Gold did not become more abundant, and that Alchemists sunk into poverty instead of rising to opulence ; with regard to the latter, it was seen, that men continued the same frail mortals as before, and that disease and death made no distinction between Alchemists and the rest of mankind. We feel ourselves entitled to expect something from those who profess much, and who voluntarily engage in great undertakings ; hence the honest Alchemist, who did not pretend to have made the discovery he aimed at, rendered his pursuit an object of ridicule ; while the unprincipled Alchemist, who falsely pretended to have made this discovery, rendered it an object of reproach. The number of Alchemists of the latter description was so considerable, as to cause Alchemy to be defined by a great Chemist \*, “ *Ars sine arte, cujus principium men-*

\* Lemery.

*diri, medium laborare, et finis mendicare,*" and this satirical definition was justified, both by the conduct and the fortune of Alchemists, in too many instances.

In the times to which I allude, it is no wonder that the discredit, incurred by Alchemy, was transferred to Chemistry, as these two pursuits appeared to be almost inseparably connected. The world was not enough enlightened by philosophical knowledge, and the province of Chemistry was not sufficiently ~~de-~~  
*defined*, to cause a distinction to be made between the proper application and the abuse of this art; I say *art*, because, in those times, Chemistry was considered more as an art than a science. The prejudice thus raised against Chemistry was very general, and the study of it, of course, held out but few allurements. The Chemist was looked upon as a solitary, footy, mysterious kind of being, who, by the aid of fire and of some other agents, produced changes in substances, more in the manner of a Magician than of a real Philosopher. His studies were regarded as confined, and incapable



pable of any connexion with the useful or elegant arts.

The first respect, in which the Utility of Chemistry appears to have been acknowledged, was in its application to Medicine. As some compensation for the discredit which the Alchemist brought upon Chemistry, he discovered, in the various processes to which he subjected Metals in order to arrive at their transmutation or at the Universal Medicine, some valuable remedies. These were introduced into practice by the boldness of BASIL VALENTINE in the fifteenth, and of the famous PARACELSUS and some other zealous chemical Physicians in the sixteenth century. At first, it is true, their introduction was strongly opposed by the majority of Physicians, who were advocates for a rigid adherence to the tenets of GALEN, and who considered these new chemical remedies as violent and dangerous. Thus, in 1566, by a decree of the Faculty of Physicians at Paris, backed by an *Arret* of the Parliament, Antimony was condemned as a poison, and all use of it, either crude or however prepared, was pro-

hibited ; and, in 1609, a Physician of the name of BESNIER, transgressing this decree, was excluded the Faculty. But if these remedies were unreasonably decried by the one party, they were as unreasonably extolled by the other. The chemical Physicians lavished upon them the most unbounded panegyric ; they were Panaceas ; they were to relieve men from all the infirmities of their nature, and to extend the term of their years to patriarchal longevity. BASIL VALENTINE gave to the book, which he wrote in favour of the medicinal use of Antimony, the high sounding title “*Currus triumphalis Antimonii* ;” and, from such a title, you may reasonably conjecture in what sort of spirit it was written. However, truth at last was discovered, and was found to lie between the two extremes of panegyric and of censure. The chemical metallic preparations appeared, on the one hand, to be less efficacious in the cure of diseases ; and on the other, to be less dangerous than they had been represented ; but, upon the whole, to be extremely valuable acquisitions to Medicine. They were probably sooner admitted



mitted to be such than they otherwise would have been, on account of the acknowledged efficacy of Quicksilver and its chemical preparations, in the cure of the venereal disease; a disease which, in the sixteenth century, made great ravages in Europe, and which was found, in one of its forms, to yield to no other remedy. The use of these new chemical medicines, in the cure of diseases, having been once established, Chemistry naturally became a branch of the studies of the Physician. It was expedient that he should know the manner of composing the metallic preparations, on which a great part of his reliance was to be placed.

Thus was Chemistry, in some measure, rescued from obloquy, and allowed to be an useful auxiliary to one important art. It was long, however, before it assumed its title to the character of extensive utility, and before it was considered as any thing more than a branch of Medicine. The connexion, even between Metallurgy and Chemistry, was not immediately perceived and acknowledged. At first sight, this may appear somewhat sur-

prising, as Chemists, in order to realize their golden dreams, had employed so much of their time in torturing metals in every possible manner. Such, however, was the case. GEORGIUS AGRICOLA, a German Physician, who, after the death of PARACELSUS and about the middle of the sixteenth century, published a treatise on Metallurgy, which may, even at the present time, be read with pleasure, in his Dedication introduces the subject of Chemistry, but by no means to its advantage. He considers Chemistry and Metallurgy as distinct arts, or, indeed, scarcely allows Chemistry to be any art at all; and dismisses it as a pursuit unconnected with the subject on which he is treating. This he does, although, in the body of his work, truth obliges him to acknowledge, in one instance \*, the assistance of Chemistry to Metallurgy.

Chemistry, then, proceeded by slow degrees in proving its connexion with most of the useful arts, and in elevating itself to the

\* P. 194. Edit. Basil. fol. 1561.



rank of a distinct branch of Natural Philosophy. For this, in addition to what has been said of the discredit which the early Chemists brought upon their studies, other sufficient reasons may be assigned. Till within the last hundred and fifty years, the study of Chemistry was merely empirical. It had, indeed, from time to time, been enriched with many facts, but the facts had not been arranged and combined. Of course it was deficient in those deduced general principles, which constitute science, and by the application of which alone to the arts, their ultimate dependence upon Chemistry could be proved. Again, Manufacturers were possessed of much less general knowledge than they are at present, and carried on their arts by certain processes, for the adoption of which they could often give no better reason than that their fathers before them had used the same. A strongly marked line was drawn between the Artizan and the Philosopher. But when Chemistry put on the form of a system, and when its principles became better ascertained, it began to be considered in the light of a science

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ence as well as of an art; and opportunity was afforded of proving, that many of the useful arts, which had been long practised and brought to considerable perfection without its aid, depended ultimately upon the principles which it had deduced. At the same time, the Manufacturer became more the man of science, and the man of science became better acquainted with Manufactures. Under these circumstances, the connexion between Chemistry and the useful arts began to be generally perceived, and, in the present improved state of this science, it is universally agreed by those who are capable of forming a proper judgment, that the successful practice of many of the most important of these arts depends, entirely, on the proper application of chemical principles. I will only mention Metallurgy, the art of Dying, of Enamelling, of making Gunpowder, Earthen Ware, Porcelain, and Glafs.

To one of these arts, that of making Gunpowder, Chemistry has a particular claim. Gunpowder is a chemical invention. But with respect to the other arts here mentioned,  
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and to the useful arts in general, it would be going too far to contend, as some over-zealous Chemists have done, that they were the fruits of chemical research. Their origin, like that of the Nile, is obscure; it is, however, reasonable to suppose that, if man was not supernaturally assisted in the discovery of them, they were the offspring of necessity, joined to accidental observation, rather than of scientific enquiry. History tells us that this was the case with the art of making Glass: that some sailors, who were dressing victuals at the mouth of the river *Belus* on the shore of *Palestine*, for want of stones having employed lumps of the saline substance, with which their ship was laden, to support their kettle, observed the sand and this saline substance run together into vitrified masses by the effect of heat; and that the genius and penetration of the *Sidonians* soon improved upon this rude discovery, and carried the art to such perfection as to derive, from the exclusive trade which they had in it, immense riches. A lump of clay, accidentally thrown into a fire, might have been observed to harden  
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whilst it retained its shape ; and on this simple observation, succeeded by gradual improvements, might have been founded the art of making Earthen Ware, and Porcelain. It is possible, also, that the first idea of the smelting of metals might have been borrowed from what was seen to take place, when a forest was consumed by fire; as superficial veins of ore might, by this means, have passed to the metallic state \*.

It is right, therefore, to consider Chemistry, not as the Parent, but as the Nurse of the useful arts. Numerous and great are the advantages, which they have already derived from the aid afforded by this science. Many of the tedious processes in Manufactures have been shortened, many of the complex ones simplified, many of the expensive ones made cheap, and many of the hazardous ones made

\* *Quicquid id est, quâcunque e causâ flammeus ardor  
Horribili sonitu sylvas exederat altis  
A radicibus, et terram percoxerat igni,  
Manabat venis ferventibus in loca terræ  
Concava conveniens Argenti rivus et Auri  
Æris item et Plumbi, &c. Lucret. Lib. v. l. 1251, &c.*



safe. Chemistry lends the same assistance to the arts with which it is connected, as the Mathematics do to those which depend on their principles. A man may be well versed in practical mechanics without being a good Mathematician; but he will, probably, be better versed if he is one: he may be a good Manufacturer if he does not understand Chemistry; but he will, probably, be a better if he does. Neither the mere philosophical Chemist, nor the mere workman, will be likely to make great improvements in Manufactures: it is when the Philosopher adds the knowledge of the practice to the theory, or the Manufacturer the knowledge of the theory to the practice, that these improvements are to be expected. By the happy union of these two kinds of knowledge, the late MR. WEDGWOOD brought the art of Pottery to so unrivalled a degree of perfection; and it may reasonably be hoped that, by a similar union of these two kinds of knowledge in other men, other arts may be equally improved.

If what I have just stated be true, if there be this intimate connexion between Chemistry

mistry and our Manufactures, the general importance of chemical knowledge to the inhabitants of this Country will not be called in question. For in our Manufactures and our consequent Commerce we justly pride ourselves; we justly look towards them, as the principal support of our national Greatness. It is chiefly by their aid, that, at the present momentous period, we are enabled to raise and to maintain such numerous forces for the defence of Religion, of Property, and of Order.

Perhaps there never was a time at which any science, that was likely to contribute to improvements in our Manufactures, was so much entitled to our attention, on their account, as the present. I do not speak merely with reference to the ability, which our Manufactures give, of supporting the unavoidable burdens of the war in which we are now engaged, but with reference also to the great advantages, which, by a spirited attention to them at this crisis, this Country may secure to itself over other nations. A few years ago, *France* took the lead in Chemistry. The  
French



French Chemists overturned old theories, established new ones, and altered the face of the science. They did not stop here; they were beginning to apply chemical principles, with success, to several Manufactures, and might perhaps soon have rivalled us in some of those, in which our superiority was before confessed. The French Manufactures are now overwhelmed by the dreadful political storms which have prevailed in that afflicted kingdom, and the Manufactures in Holland have suffered from the same cause. On these grounds, the Manufacturers of this Island have the greatest inducement to call in every aid to the improvement of their arts: in the nature of things they must, for some time, have a large demand for the articles which they prepare; and, if they can bring their processes to a high degree of perfection, it may be very long before a competition can be instituted by any other Country. Circumstances are very favourable to their efforts: luckily for them, they can carry on their experiments without molestation; the smelter is not forced from his furnace, nor the potter from his lathe, by civil dissensions, and  
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the theatre of the war which we wage with our foreign enemies is, and, whatever they may desperately attempt, we trust will continue to be, remote ; our Commerce, moreover, is flourishing and protected. The British Manufacturer is assisted by present advantages, as well as incited by the most encouraging future prospects.

Agriculture, the other great source of our national prosperity, has also an intimate connexion with the science, the Utility of which I am endeavouring to shew. Chemistry has ascertained the number and nature of the different earths which enter into the composition of soils, and has laid down easy rules by which they may be distinguished from one another, and the proportion of each be accurately known. Hence there is every reason to suppose, that it may be resorted to, as a much surer method of determining the quality of soils, than the eye or the taste of a Land-surveyor : for the basis of every soil is an admixture of these earths in certain proportions. The presence of vegetable substances in a soil is, we know, necessary to fertility ;



fertility ; but Chemistry detects these, likewise, and proportions them with accuracy. I am aware that the goodness of a soil, and its fitness for one or another sort of culture, must depend upon other circumstances, as well as upon the proportion of the component parts of the soil itself. Its situation as high or low, its exposure to sun and wind, the subjacent strata, and more particulars must be taken into the account. But these must be taken, equally, into the account, in either mode of judging of the quality of soils ; and, with respect to the nature of the subjacent strata, that can be best determined by chemical means.

The general operation of Manures, and the peculiar fitness of this or that manure for this or that particular soil, are not so well understood as might be wished. Some light has been thrown, and much more may be, on this important part of Husbandry, by ascertaining the quality of soils, in the manner above alluded to, with philosophical exactness. From the prevalence of one constituent part of a soil, and the small proportion of another, we might, in many instances, judge, *a priori*, what kind of manure

was best suited to the soil under consideration ; or, at all events, when the best manure had been determined by experience, the fact might be made extensively useful to the present, and to future generations, because the exact nature of the soil could be stated, with unerring precision. Thus agriculture, with the aid which Chemistry is ready to lend it, may, in future times, be conducted upon sure scientific principles.

We may look forward to these improvements, with the greater confidence, because Chemistry has made considerable progress in ascertaining the nature of Vegetation itself. It appears to have gone a good way towards discovering how far the different substances, contained in a soil, are the direct food of plants, and how far they are favourable to Vegetation, merely by affording a proper bed for the reception, and transmission, of the nutritive particles. These discoveries it has been enabled to make, principally, by the recently acquired knowledge of the different aeriform substances ; substances, which are found to act a much greater part, than could formerly have



have been imagined, on the great theatre of Nature.

The Farmer and the Chemist have, generally, been looked upon as characters so remote from each other, that what I have said may be thought by those, who have not given their attention to the subject on which I am speaking, to be mere theory. But when they shall have acquired chemical knowledge, sufficient to enable them to comprehend the writers on this subject, they will find the connexion, between Chemistry and Agriculture, fully established. The theory is not unsupported by practice. This may be seen, by comparing the chemical with the practical authors on Agriculture ; by comparing, for instance, the observations of LORD DUNDONALD, and MR. KIRWAN, with those of MR. YOUNG.

At all times, Agriculture ought to be a favourite object of the care of an enlightened Nation. As the dawn of civilization commences when the plough and the spade begin to come into use, so should advances in refinement be attended with proportionate

advances in Husbandry. In some points of comparison, Husbandry claims the preference to Manufactures. While the latter ebb and flow, like the sea which carries their products, the former, like a noble river, keeps a direct and steady course, and varies but little from the same level: the latter are often seen to corrupt the mind, and enfeeble the body; the former disposes to temperance and serenity, and produces a manly race of subjects, inured to toil, and capable of bearing every vicissitude of weather. To dwell no longer on this comparison, I proceed to say, that the observation which I made when speaking of Manufactures, that they, and any science which was likely to contribute to their improvement, never more demanded our attention than at present, will apply equally well to Agriculture, although from a different and more urgent principle. We are, at this time, stimulated to agricultural improvements, not so much with the prospect of enriching ourselves by administering to the wants of other Nations, as of producing a sufficient supply



supply of provisions for the use of our own. It is not long, since we were under the alarm of an impending scarcity. The regulations, the example, and the salutary recommendations of the Legislature, together with the blessing of an abundant harvest, have now quieted our apprehensions. But we shall study our best interests, in endeavouring, by an attention to husbandry, to prevent a recurrence of the same distressing fears ; in striving to make our own Granaries certain resources ; in not putting the wisdom of Parliament to the test, whose best contrived plans, on such emergencies, may be disconcerted by the opposition of winds and waves, or by the vigilance of an enemy ; in not tempting Providence, by depending, for our subsistence, on the uncertain amount of any succeeding year's produce. There is nothing visionary in such an object. Whatever may be the comparative state of Agriculture in this and other kingdoms, no intelligent persons deny, that, with us, it has not yet reached its highest pitch of excellence ; that, in many districts, the mode of practice is evi-

dently defective, and, in the most improved, room is still left for the suggestions of experience and ingenuity. Notwithstanding its importance, this does not seem to have kept pace, in its improvements, with other practical arts. The true cause is perhaps to be sought in some natural difficulties, which attend experiments in Husbandry. Experiments, relating to other arts, may be performed in a short time ; the experimenter may be an eye-witness of the processes in every stage ; and may exclude every agent that can make the conclusion doubtful : while experiments in Husbandry require the revolution of seasons ; preclude minute ocular observation, because Vegetation is an obscure process ; and are influenced by the anomalies of the weather, which may lead to an uncertain result. However, be the difficulties what they may, the success, which has of late years attended enquiries into our rural economy, may be adduced as a proof, that they are not insurmountable ; and the application of chemical principles will, it may be trusted, greatly facilitate our exertions. Let me add to what

I have



I have already said, of the claim which Agriculture has to our attention from the particular circumstances of the present period, that the enclosure of common and waste lands is in agitation ; and, if such plan take place, of what vast consequence is it, that the principles of Agriculture should be well and generally understood, in order to turn the great variety of fresh soils, which would thus be subjected to culture, to the best account ?

I cannot quit this head of my Lecture without remarking, that to those, who entertain sentiments similar to what have been just expressed, it must be a matter of solid satisfaction to be able to look up to a late noble institution, in this country, the BOARD OF AGRICULTURE ; an institution, which derived its origin from pure public spirit, and the promoters of which must eventually meet with an adequate reward, the consciousness of having contributed to public prosperity.

Possibly, what I have hitherto said may be allowed ; and, yet, the Utility of the study of Chemistry to the Members of an University may be

questioned. For it may be urged, that what I have said amounts to no more, than that the knowledge of Chemistry is useful to the Physician, the Manufacturer and Farmer. To this observation it might be replied, that, although the Physician has the opportunity of informing himself in every department of science, the Farmer has not ; neither has the Manufacturer, notwithstanding that the avenues to science are more open to him than they were, so often as might be wished. The time, allotted to the education of the Farmer and Manufacturer, is, for the most part, but short ; they are placed, at an early age, in the lines of business which they are to pursue ; and from this time they are employed in acquiring manual dexterity, or in learning the common routine of their businesses, rather than in informing themselves of the scientific principles, upon which they are carried on. From this cause it has happened, that improvements in Manufactures and Agriculture have been so frequently made by philosophical men ; by men, more remotely interested than the Manufacturer or Farmer in the improvements which they



they suggested, and directing their attention to these subjects from patriotism and the love of science.

I might, therefore, recommend the study of Chemistry to academical Gentlemen, upon this general consideration, that it is on our Universities and Public Seminaries, that improvements in Manufactures and Agriculture ultimately depend; that in the former are situated those fountains of science, whence the streams, by which the latter are watered and nourished, are supplied. Considerations of this sort may, however, be looked upon as too abstract and remote; and I will, therefore, endeavour to point out, in what particular respects the study of Chemistry may be useful to the different descriptions of Gentlemen, who resort to the University as a place of education; to Gentlemen of fortune, to Students in Divinity, in Physic, or in Law.

Of Gentlemen of fortune, who do not intend to follow any profession, it may be observed, that many of them will, at some future time, be members of one of the British Houses of Parliament. In this capacity, they  
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will often be called upon to decide on questions, highly interesting to our Manufactures and Commerce. A tax upon this or that manufactured article, or this or that material employed in Manufactures ; a duty or a bounty upon certain goods, exported, or imported ; a commercial treaty : topics, such as these, are frequently discussed in the British Senate. The knowledge of Chemistry may, if directed to this object, have given them an insight into our Manufactures ; from an acquaintance with our Manufactures, it is but another step to have become acquainted with Commerce ; and thus they will have proceeded systematically, instead of adopting loose and changeable ideas on such important subjects. Some of those Gentlemen of fortune, who do not enter into public life, may have a fondness for Agriculture. If they have, an opportunity is afforded them of trying, at least, how far Agriculture may be improved by an application of the principles, which Chemistry has taught them. Should they fail to improve it, they will experience some satisfaction in the idea of having been rationally employed, and will probably have spent no more money, than  
might



might otherwise have been required for the gratification of less patriotic pursuits: should they improve the state of our Agriculture, they will, sooner or later, feel the advantage in the increase of their rentals, and will deserve to be ranked among the greatest benefactors to their Country. It may be, that, instead of a taste for Agriculture, they have a taste for Natural History. With regard to two branches of Natural History, *viz.* Zoology and Botany, Chemistry may not appear, at first sight, to have any immediate connexion with them. It has not, in the confined view which is often taken of these sciences, and which makes the Zoologist and the Botanist, mere nomenclators. But the accomplished Zoologist does not confine himself to the classification of animals, nor does the accomplished Botanist to the classification of plants. The former enquires into the anatomical structure of animals, and into the nature and chemical properties of the animal solids and fluids; the latter enquires into the anatomy of plants, knows their chemical analysis, and must bring Chemistry to his aid, in order to understand  
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what is known concerning the vegetative process. To the successful study of Mineralogy a knowledge of Chemistry is absolutely essential : minerals are classed according to their chemical properties, and they most frequently undergo a nice chemical examination, (so indecisive are their external qualities) before they can be referred, with certainty, to any particular class.

The property of some Gentlemen of fortune consists, in part, of metallic mines. To these it is impossible to pay too minute an attention : in the large way in which they are often worked, great profit or great loss may depend, upon what, when applied to small quantities of the metals, appears a trifling difference, in the price for which they can be procured from the ore, or for which, on account of their quality, they can be sold. The difference of a single halfpenny *per* pound may make or may mar a fortune. In circumstances like these, a Gentleman would surely wish to know the principles upon which mines are worked, and not to rest entirely on his opinion of the skill and integrity



grity of others, where he has so much at stake. This knowledge he must gain from the science, which I am endeavouring to recommend ; the working of metallic mines being, exclusive of the mechanical contrivances, conducted entirely upon chemical principles.

To those Gentlemen, who are intended for the Church, I might only say, that Chemistry is now esteemed one of the liberal branches of knowledge ; so great has ever been the general character of the English Clergy, for information in every department of learning and science. But at the same time that the student, of this class, gratifies his thirst after extensive information, by yielding to the allurements of chemical studies, he will find that they may be turned to account. A few of the Clergy are Members of the upper House of Parliament ; it ~~falls to the lot~~ of many to live in the country, where they are often necessitated to engage in the concerns of Husbandry, even in their own defence ; and, in such instances, they would have to lament their

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their want of the knowledge of the principles of Agriculture. If they are not necessitated to engage in such concerns, they may wish to fill up their leisure hours in cultivating some branch of Natural History. I must be permitted to make a further remark, the force of which may be felt by some Students in Divinity, and this is, that the honourable charge of the instruction of youth falls, in general, to the lot of the Clergy, and that it is incumbent upon such, as engage in this employ, to be acquainted with the branch of Natural Philosophy of which I am speaking. It is daily becoming more and more popular, and they should be able to communicate some general idea of it, at least, to those, who rely upon them for the foundation of their literary and scientific acquirements.

After what I have already said of the connexion between Chemistry and Medicine, it will readily be allowed, that the knowledge of Chemistry is necessary to the Student in Physic. The Physician, who is ignorant of Chemistry, cannot be well skilled in his profession ;



feſſion ; and, indeed, cuſtom now makes Che-  
 miſtry one of the initiatory parts of the edu-  
 cation of medical Students. Yet there is rea-  
 ſon for ſuppoſing, that medical Students, in  
 general, are not ſufficiently aware of its im-  
 portance ; and we ſometimes hear it ſaid,  
 both of Chemiſtry and Anatomy, that ſuch a  
 perſon knows enough of the one, or of the  
 other, for a Phyſician ; as though a Phyſician  
 was to content himſelf with a general ac-  
 quaintance with theſe neceſſary aſſiſtants to  
 his art, and to leave the more particular ac-  
 quaintance with them to the mere Chemiſt,  
 and the Surgeon. The importance of Ana-  
 tomy to the Phyſician, it is not my province  
 to ſhew ; but of Chemiſtry I muſt obſerve,  
 that the Phyſician ſhould not reſt ſatisfied  
 with a general knowledge of it. If he does  
 not drink deep, he may almoſt as well not  
 taſte of this ſpring of ſcience. In the firſt  
 place, it will greatly aſſiſt him in his phyſio-  
 logical enquiries: the Phyſician ſhould be able,  
 in proſecuting this part of his ſtudies, to com-  
 prehend, and, if occaſion require, to make the  
 chemical analyſis of the different ſolids and  
 fluids

fluids of the human body. I would not be understood to argue, that the knowledge of the chemical composition of the human solids and fluids leads us directly, or necessarily, to the knowledge of the manner in which they are formed. We cannot account for Digestion, Sanguification, and most other animal processes, upon those principles which we can apply, with success, to explain the changes which take place in inanimate matter; and the chemical Physicians, who, in the last century, looked upon the human body as a mere Laboratory, were, perhaps, guilty of nearly as great an error as the mechanical Physicians, who thought it a mere Machine, the animal functions of which could be explained upon the principles of the Cartesian Philosophy. However, without a knowledge of the component parts of the different solids and fluids of the human body, the physiological enquirer will make but little progress; he, who wishes to investigate obscure causes, must lay the foundation of his researches in the knowledge of the effects. It would be doing injustice to Chemistry, to dismiss the subject of Physiology



logy without intimating, that one of the most important of the animal functions, Respiration, is, in part, a truly chemical process, and that it cannot be comprehended by those, who have not made some advances in chemical studies.

Chemistry is as much an auxiliary to pathological, as to physiological enquiries. In considering the nature of diseases, a share of the Physician's attention will be directed to the chemical changes, which they produce on the human frame; and this enquiry presupposes the knowledge of the chemical state of the human solids and fluids, in a state of health. I should be sorry to overvalue the Utility of Chemistry, while I profess to state its just pretensions only: and, therefore, as I have already remarked, that the chemical examination of the human solids and fluids, in a state of health, does not directly, or necessarily, lead to the knowledge of the manner in which they are formed; so would I here observe, that this examination of the changes, wrought upon the solids and fluids by disease, does not directly, or necessarily, point out the method

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of cure. Such an examination, however, must form an essential part of a correct pathology; and there are some instances, in which the cure of formidable diseases is successfully attempted by the direct application of the principles of Chemistry. Of this nature are those, where acrimony is present in the stomach, whether it has been generated there, or whether acrimonious substances have been swallowed by mistake, or for the purposes of suicide. The chemical examination of the stone of the bladder, a substance concerning the composition of which very erroneous notions had been before entertained, appears to have conducted us to the use of those remedies, which have proved most safe and most serviceable in calculous disorders; and the chemical difference observed in the blood, after drowning and other modes of suffocation, has enabled us to reject the useless, and to practise the most promising means of restoring those, who have suffered from such accidents.

An accurate knowledge of the *Materia Medica*, and of the various medicinal preparations, is one of the first requisites in  
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a Physician. To judge how far this knowledge is derived from Chemistry, we need only take up a *Pharmacopæia*. It will there be seen how large a part of the remedies, now in use, chemical substances form, and what a number of chemical processes are directed for making them. From the days of PARACELSUS, the feeble remedies, proposed by GALEN, have been giving way to the more powerful products of the Laboratory. “*Inter-  
ea temporis Medicina . . . . . adjumenta . . . nec  
pauca nec parvi æstimanda, tum aliorum indus-  
triæ et inventis accepta retulit, tum eorum, egre-  
gie et præter cæteros, qui nuperis abhinc annis  
in Chemiam altius subtiliusque excolendam acriori  
studio incubuerunt,*” is the language of the clas-  
sical preface to the late edition of the Lon-  
don *Pharmacopæia*, alluding to the state of  
Medicine within the preceding fifty years.  
Physicians, it is true, do not themselves pre-  
pare the Medicines which they use; but to  
know how they are prepared is the surest way,  
by which a Physician can enable himself to  
distinguish them readily, and to form a pro-  
per estimate of their goodness: occasionally,

too, he may wish to direct a chemical process, at length, in his prescriptions. Whether he may wish this or not, it may be justly affirmed, that if he be not thoroughly conversant with the chemical remedies which he employs, if he do not know the different degrees of affinity which subsist between the more simple chemical substances, he will commit great mistakes in his ordinary manner of prescribing. He may bring together compounds, which shall decompose each other, and produce new compounds, very different in their medicinal qualities. Thus, where he intended to give a mild medicine, he may give one that is rough; where he intended to give an active medicine, he may give one that is inert. In other cases, he may bring together substances, which, from their want of chemical affinity, are either incapable of being made up in the form which he prescribes, or which make a very inelegant and unpalatable composition; and the result of the whole is, that, in these errors through want of chemical skill, the health of his patients will suffer in many instances, his own professional character in all.

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The practice of exhibiting factitious airs, as medicines, is, at present, to be considered as a matter of experiment, and therefore I do not enlarge on this topic. Should the credit of it ever be established, the Physician would be called upon, more than ever, to cultivate chemical knowledge.

In speaking of the Utility of chemical knowledge to the Physician, I am persuaded I have said no more than what justice required. Let it not, however, be imagined, that I deny their importance to his other assistant pursuits. The medical student must be attentive to the Hospital and to the Dissecting Room, as well as to the Laboratory. It does not follow that the best Chemist will be the best Physician, although it may be safely asserted, that a man cannot be a good Physician without being a tolerable proficient in Chemistry.

To those, who are intended for the study of the Law, no kind of knowledge can be useless, so various are the questions upon which the Lawyer is obliged to speak. As I  
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am addressing myself to a classical Audience, it may be presumed, that few of them are unacquainted with CICERO's Dialogues *de Oratore*, a work, upon which that extraordinary man appears to have bestowed the utmost care. With some exceptions on account of the greater precision and perfection of our laws, and on account of the different circumstances attending the Roman Forum and the English Bar, the directions, which, in the person of CRASSUS, CICERO gives for forming a complete Orator, will apply for the most part to the English Lawyer. The same wide compass of knowledge is necessary to form the character of a perfect English Lawyer, as was to form the character of a perfect Roman Orator. It must be allowed, that many have been conspicuous at the English Bar, who could boast of no attainments in literature or science; natural abilities have done much of themselves. But the same natural abilities, combined with extensive information and erudition, would have done more; and it may reasonably be supposed, that the aspiring law-student of an English University aims at excellence; that

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he is willing to avail himself of every collateral aid ; that he is more inclined to adopt the enlarged views of CRASSUS, in the Dialogues before mentioned, than the confined notions of ANTONIUS ; and, when a particular cause occurs, would wish to be able to draw from his own well-arranged stores of knowledge, instead of relying entirely on the loose and confused ideas, which he can collect from others on the urgency of the moment. If the sentiments of the law-student are thus liberal, he will probably not think Chemistry undeserving of his regard. He will recollect, that, in a trading and commercial Nation, law questions frequently occur which require a knowledge of our Manufactures ; and the proper way to attain this knowledge is to begin with the chemical principles, upon which Manufactures are conducted. Sometimes, in a dispute about a Patent for instance, these very principles may be the subject of his Brief. Another incentive may be mentioned, which is, that the Lawyer, if he arrive at eminence, will become a Member of Parliament, and, in this capacity, he will derive the same advantages

tages from an acquaintance with Chemistry, which I observed that Gentlemen of fortune would, if placed in that situation.

So much for the particular respects, in which a knowledge of Chemistry may be found useful to the different descriptions of Gentlemen of this University. There are some points of view, in which it is equally useful to every description. It must be conceived that those, who have had the advantage of a liberal education, who have visited an English ATHENS, cannot but have imbibed something of that laudable curiosity, which makes them desirous of being able to account for those remarkable appearances and processes in the world about them, some of which are almost constantly present to their senses, others of which more rarely occur, but arrest attention by the grandeur that they exhibit, or the terror that they impress. The theory of most of these appearances and processes is to be sought for in Chemistry. Do we wish to know why metals rust? why fire burns?  
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why atmospheric air supports life? why the exhalation of paint and the fumes of charcoal are pernicious? why we see meteors in the heavens, or volcanic eruptions upon the earth? it is to Chemistry we must look for an explanation of these, among other Phænomena.

The above are all the observations, which I have to offer on the Utility of Chemistry. Much might be said upon it as an engaging study, were this a topic on which I had proposed to enlarge. As I have not, I must be satisfied with two general remarks. The first is, that chemical information is acquired in that manner, which is most gratifying to the vanity inherent in the human mind: “*ipse sibi tradit spectator* ;” the Chemist appears to teach himself, as the knowledge, that he gains, is deduced from experiments, which he either sees or makes. I may add, that these experiments, for the most part, are agreeable to the eye, and that some of them are striking and beautiful. The second remark is, that, in this study, alternate thought and ac-

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tion relieve each other : at one time the mind is employed on theory, at another the hands are employed in practice ; one day the Chemist is contriving experiments, the next he is making them.

What I have to say, respecting the object at which my Lectures will principally aim, will occupy only a small portion of your time.

From the estimation in which chemical knowledge now begins to be held, my Class may possibly consist of Gentlemen, who differ much with regard to their present chemical attainments. There may be some, who have already entered into the refinements of Chemistry, and to whom nothing, which I could say, would be entirely new : there may be others, who have laid the foundation of this study, and who wish to raise the superstructure ; but the majority must consist of those, who have as yet made but little progress in it ; of those, who have hitherto mostly directed their attention to classical learning,



ing, but are now desirous of extending their views over the fields of science. It is to Gentlemen of this last description that I shall chiefly address myself. I shall endeavour to deliver the elementary parts of Chemistry in as familiar a manner as possible ; to avoid the minutiae of chemical controversy ; in short, to make the access to the science as easy as may be. This plan, whilst it is best calculated for the greater part of my Audience, may not be altogether without it's use to those who are already Chemists. The elements of a science are to that science, what Grammar is to Language : and if great Scholars have confessed, that they have read their Grammar over and over again with profit, the good Chemist may, perhaps, reap some advantage from an elementary Course of Lectures. He may condescend to be reminded, where he cannot be informed.

I wish to have it understood, that I shall not, because I am a Physician, dwell too much upon pharmaceutical Chemistry. I do not, on the one hand, resign the privilege of no-  
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ticing the applications of Chemistry to Medicine ; neither shall I be so biaſſed by my profeſſion, on the other, as to give them a particular conſideration. I ſhall bear in mind that my Claſs does not conſiſt entirely, or even principally, of medical Students.

My object will be, Perſpicuity, and general Utility.

THE END.







